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Long Term Relationship Between Geomagnetic and Solar Activity Parameters

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ABSTRACT

The solar and geomagnetic activity parameters for the period of 1986 to 2010 have been analyzed for both the solar cycle 22 and 23. The most of the geomagnetic parameters have been found to be related with sunspot numbers. The yearly average values of solar wind electric field 'V.B.' are cross plotted with Rz and Ap. It is observed that these parameters are highly correlated with each others. A strong correlation between solar flare index (SFI) and Rz is also observed.

Keywords: Cosmic ray daily variation, sunspot number, geomagnetic parameters and solar activity**.**

INTRODUCTION

Short-term solar variability and their impact on geomagnetic field have been studied since long time. Many mechanisms have been proposed time to time to explain the Short-term solar variability and their impact on geomagnetic field. Venkatesan *et al*. 1990 and Singh *et al.* 2006, have reported a significant influence of high speed solar wind on geomagnetic activity enhancement and cosmic ray modulation. C.M. Tiwari et al, 2005 have reported the average anisotropy characteristic of high energy cosmic ray particles and geomagnetic disturbance index Ap. These features produce Short-term solar variability and their impact on geomagnetic field. Long term variability in solar wind velocity and IMF intensity has been studied by Rangrajan *et al*. 2000.

A number of investigators (Agrawal et.al, 1983, Ahluwalia 1992, Gopalswamy *et al*. 2001, and Kane, 2003) have proposed that the agent which is transporting the geomagnetic activity information, in form of magnetic perturbations and causing cosmic ray modulation are coronal mass ejections. Various interplanetary characteristics, such as low solar proton temperature, solar wind

ion charge state and compositional anomalies; the generation of shock upstream of fast ICMEs which may be important accelerators of energetic particles. High and low Ap values also indicated disturbed and quiet interplanetary media. In the present work we have derived the long term relationship between various solar and geomagnetic activity parameters for the period of 1986 to 2010.

DATA ANALYSIS

The basic data of the solar and geomagnetic activity parameters such as Rz, SFI, Ap, V and B have been received from NSSDC Omni tape and from the updates available on the web sites. The annual average value of magnetic field B, solar wind velocity V and the product V.B for the period of 1986 to 2010 have been computed. These values are cross plotted to show relationship between them.

RESULT AND DISCUSSION

In this analysis, we have used the yearly averages of V.B and Ap for the period 1986 to 2010. The yearly averages of theses indices have been plotted and shown in figure 1. The correlation Coefficient (0.91) between these parameters have been calculated and shown for the solar cycles 22 and 23. Both the parameters are highly correlated with each other. We have also plotted the yearly average values of V.B and Rz for the period 1986 to 2010 as shown in figure 2. Both the parameters are positively correlated (corr.coef. 0.65) with each other. Figure 3 shows the cross plot between SFI and Rz.It is clear that there is a strong correlation of solar flare index with that of sunspot number. The correlation coefficient between these two indices is found to be 0.97. The solar wind electric field represented by 'V.B.' is linearly correlated with Ap. It is observed that when the magnetosphere is somewhat less disturbed, large change in velocity leads to less significant changes in geomagnetic activities, which need further investigations.

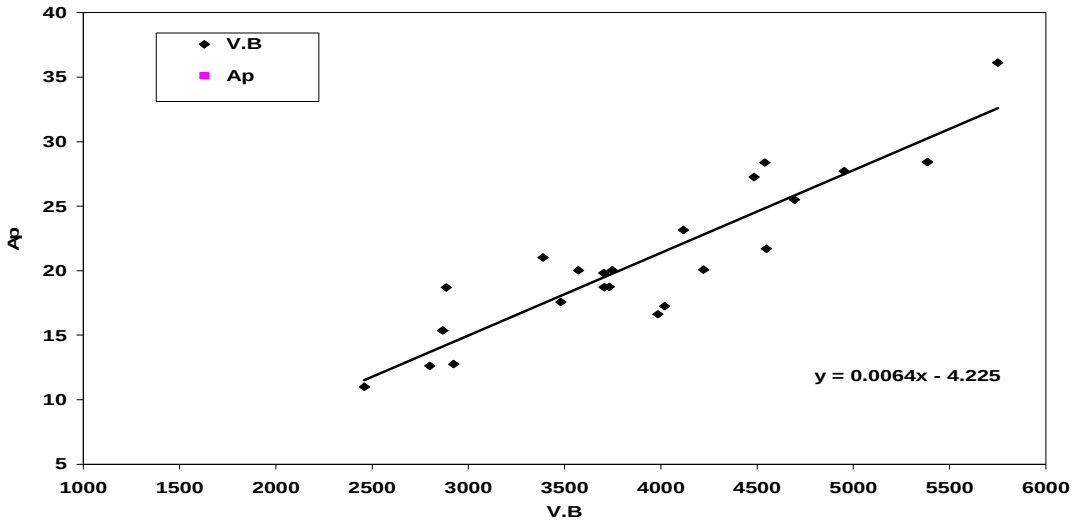

Figure 1 Shows the cross plot between V.B and Ap for the solar cycles 22 and 23.

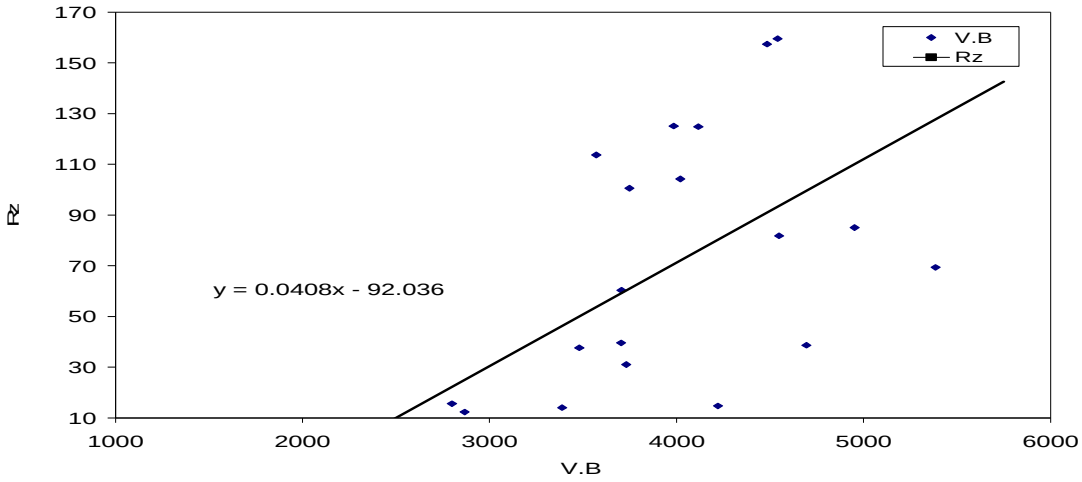

Figure 2 Shows the crossplot between V.B and Rz for the solar cycles 22 and 23.

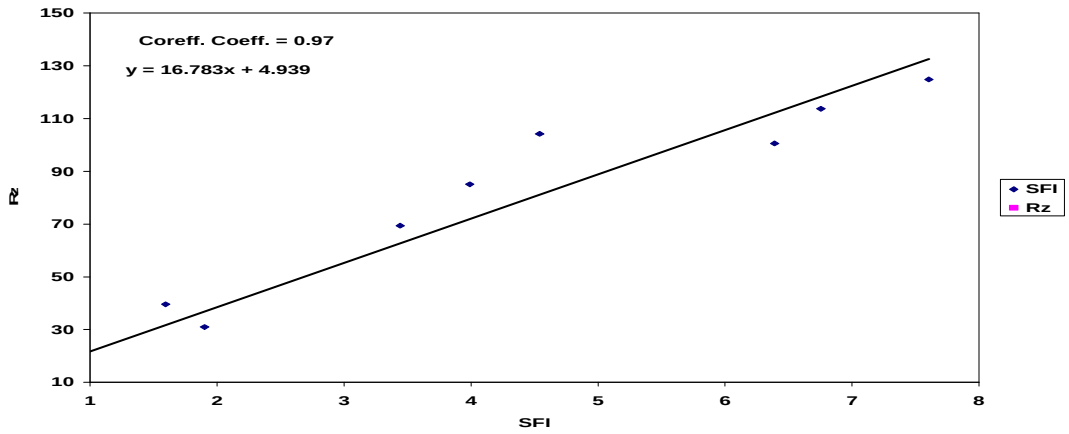

Figure 3 Shows the cross plot between SFI and Rzfor the solar cycles 22 and 23.

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